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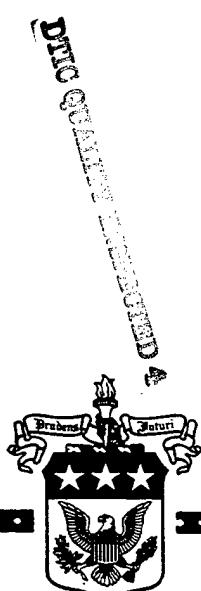
**DOD'S STRATEGIC LOGISTICS SYSTEM:
COMMERCIALIZATION VS. MASS**

BY

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United States Army**

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ABSTRACT

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In safeguarding U.S. interests, the Defense Department must maintain its technological predominance and globally competitive national industrial base that can support the Nation's future defense needs. The Department's processes and policies must facilitate the rapid purchase of state-of-the-art products and technology while supporting the transformation of defense-unique companies to dual-use production while preserving defense-unique core capabilities. As the Army begins to maximize information technologies and as advancement of military and civilian precision systems accelerates, strategic logistics will represent a subset of U.S. national power. Defense-unique companies and military depots now provide the majority of our strategic defense needs. In the future, commercial firms will provide the vast majority of military logistic requirements, with a much smaller portion provided by defense-unique companies and military depots. Commercial firms will become "linked at the hip" to the military at installations, during training exercises, and even in the heat of military conflict.

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Logistics involves the creation of time, place, quantity, form, and utility with and among firms and individuals through strategic management, infrastructure management, and resource management, with the goal of creating products/services that satisfy customers through the attainment of value.¹

Carrying out its Cold War strategy and spending, the United States (U.S.) military produced a huge military-industry complex, supported by a dedicated defense-unique industry and a huge depot system and support infrastructure. Large government and contractor organizations and support concepts were designed to support our forces "in mass." We created and stored massive inventories in the U.S. and at overseas supply bases. During conflicts, we created pipelines through which materiels were pushed almost indiscriminately, in huge quantities, into the area of operations. This was our way of providing logistics support at the precise time and place of the conflict. However, this "mass" delivery was not necessarily effective: there were lengthy delays in delivering materiel from the government and defense-unique industrial bases; old configurations stored in the supply system; and users mistrusted the system.²

Since World War II, the Department of Defense (DoD) has driven technological developments in many critical areas through its national labs or through funding major defense-unique contractors. However, commercial technological development now outpaces DoD Research & Development (R&D) and production in many key technologies that are critical to military superiority: computers, software, integrated circuits, communications, and advanced materiels.³

In addition, with a procurement budget that has declined more than 60 percent in real terms since FY 85, we have seen mergers, acquisitions, and major downsizings within the defense industry. On a lesser scale, the government's industrial base and its infrastructure have also taken budget cutbacks. All of this is causing major shrinkage within the nation's industrial base.⁴

To protect our national interests, DoD must maintain its technological predominance and globally competitive national industrial base in order to support the Nation's future defense needs. DoD's processes and polices must facilitate the rapid purchase of state-of-the-art products and technology, support the transformation of defense-unique companies to dual-use production, support the conversion of depots to the commercial environment, and preserve defense-unique core capabilities.⁵

As the Army begins to maximize information technologies and as advancement of military and civilian precision systems accelerates, strategic logistics will represent a subset of U.S. national power. Defense-unique companies and military depots now provide the majority of our strategic defense needs. In the future, commercial firms will provide the vast majority of military logistic requirements, with a much smaller portion provided by defense-unique companies and military depots. Commercial firms will become "linked at the hip" to the military at their installations, during training exercises, and even in the heat of military conflict. The following study examines how commercial industry has redesigned itself and analyzes this industry's capability to serve the nation's future military needs.

LOGISTICS – THEN & NOW

Military logistics is a very complex and encompassing process, one that not only incorporates the complete life of a military system, but which also requires key linkage with other strategic suprasystems. The logistics process has several distinctive attributes. First, it is comprehensive, extending from the source of raw materials to the customer's work site. Located anywhere in the world, the customer uses what the system provides to accomplish a peacetime repair or a wartime mission. Second, this process is sustained by a synergistic relationship between information and product. Both are vitally important to quality performance. Third, logistics processes must coordinate, as well as integrate, a number of interdependent activities simultaneously across major functional areas. Most important, the system depends on the nation's industrial base to develop, produce, and maintain the weapons and supporting defense equipment needed to meet U.S. national security objectives.⁶

The logistics systems, processes, organic capabilities, and inventories have evolved over the years to support our military. Military logistics reflects the business processes and technology of the '50s, '60s, and '70s. But this culture has created an inefficient, slow-moving acquisition process, limited in-transit visibility, and a lethargic, inefficient distribution system. We now maintain "just-in-case" inventories worth \$60 billion, which pose tremendous problems in storage, management, and disposal. This situation is visible enough to have attracted 60 Minutes coverage a few years ago. The procurement budget has decreased more than 60 percent in real terms since FY 85, while the logistics slice currently consumes 50 percent of the DoD budget.⁷

During Desert Shield and Storm, reports of clogged ports, unknown contents inside containers, and orders clogging procurement and distribution channels drew attention to our logistics morass. Unfortunately, this war seems to have validated an outdated logistics theory of inconceivable mass and the deployment of "just-in-case" quantities of materiel and supplies.⁸ In an age of integrated customization, the old "buy-make-move-sell" criteria fails to meet the needs of a constantly changing global economy.⁹

Reductions in defense budgets are causing the services to reduce their procurement and R&D programs. This slow-down increases the service life of current weapon systems and the cost of supporting these systems. Using current logistics practices, we will encounter increasing problems supplying repair parts and maintenance items. The technological life cycle of military-unique components and the decreasing population of defense-unique manufacturers to build these components will make them scarcer, which will increase the logistical problem of delivering these when and where they are needed.¹⁰

Under Secretary of Defense for Acquisition and Technology, Dr. Paul Kaminski has aptly summed up the problem: Our current system is "best characterized as a multilayered support system employing a demand-based system with large inventories which is in stark contrast to the just-in-time materiel management systems being implemented by commercial enterprises."¹¹ Defense-unique and government organizations now face major conversion challenges that many private companies faced in the 80s. Successful companies regenerated their strategies and reinvented their industries; many of them are now viewed as leaders in the global market.¹²

DEFENSE INDUSTRIAL BASE -- THEN & NOW

Immediately after World War II the U.S. devoted serious attention and resources to building up its defense-unique industrial base, particularly to provide nuclear systems essential to the Cold War strategy of deterrence. Following Vietnam, the nation began building the world's largest conventional and most technologically advanced military. Defense-unique companies and associated government infrastructure exploded in size and number, forming an industrial base that separated itself from the commercial world. However, the end of the Cold War has brought about a qualitative, as well as quantitative, change in our defense needs. Senior military leadership and managers of defense industries encountered new missions and force structure not so amenable to reduced budgets, large defense-unique and government organizations and processes, complicated by ownership of the world's most costly & technologically advanced weapons.¹³

The steep deterioration in defense procurement contracts--with the resultant mergers, acquisitions, and bankruptcies of defense companies--has led to a recent dramatic shrinkage in the defense industrial base. By 1993, defense industries were using only 35 percent of their industrial capacity, but their fiscal planning called for 85 percent efficiency. As procurement budgets pursued their downward slide, industry efficiency continued to rapidly decline--even though the base was shrinking. Then the defense industry failed to attract long-term investment capital because of the absence of future growth potential, of their heavy dependence upon congressional subsidies, and a degenerating foreign military sales market.¹⁴

To make matters worse in the 80s, Congress enacted special defense laws, policies, and business practices creating boundaries between the defense and civilian industrial sectors.¹⁵ DoD's systems (hardware and software) development policy required a contractor to design, develop, produce, and field a new or modified weapon system and its associated logistics support. The government then divorced themselves from the original manufacturer upon fielding the system. After the divorce, logistics support required new or additional governmental infrastructure(s), process(es) and facility(ies), adding to the already massive system.

Federal, DoD, Service, and Agency headquarters added more procurement regulations, accounting standards, and military specifications to ensure that the "Bad Military Contractors" were not cheating the government. This formidable wall between the civilian and defense industrial bases completely "discouraged the sharing of human resources, facilities, technologies, and production lines that offers cost savings and efficiencies through economies of scale and scope."¹⁶

This culture led to even larger government and defense industry bureaucracies, which then predictably generated a myriad of transfers across organizational boundaries to execute processes and special management actions. These actions then required business decisions to be based on archaic policies, which blocked timely responses to high-priority requisitions and obfuscated effective management of the system. Procurement and repair of military materiel took two to three times longer than comparable commercial practices. As the process became more inconsistent, the soldier distrusted the system, which led to work-arounds or actions outside the system that wasted resources and further deteriorated process performance. These practices

and processes are obviously inadequate, often ineffective, and not-well suited to provide the management and agility required to support future military operations.¹⁷

The commercial marketplace, not the defense establishment, now has assumed technological leadership in a significant number of required military technologies. This leadership pertains not only to materiel production, but also to distribution and manufacturing technologies and applications. In fact, new DoD technology falls well behind most commercial technology introduced each day into the world marketplace. In 1965, DoD acquired 60 percent of the semiconductors built in the U.S.; today, DoD procures closer to 1 percent of all semiconductors produced.¹⁸

Emerging technologies that are critical to precision strikes, to dominating maneuver, and to information warfare concepts are being driven by accelerated commercial demand, not by military demand.¹⁹ Even so, the Carnegie Commission on Science, Technology and Government concluded in 1991 that, "In effect, the United States has two technology bases, a defense technology base and a commercial technology base."²⁰ To provide the agility required in today's changing environment, the U.S. economy can no longer pay for two non-integrated technology bases especially when one of them lags considerably behind the other.

COMMERCIAL INDUSTRY

Joseph Schumpeter, one of the 20th century's great economists, described capitalism "as a process of creative destruction. New industries constantly come into existence as old industries are destroyed."²¹ Global industries worldwide model themselves on the U.S. commercial market. Vibrant competition for profit and growth,

commercial firms balance supply and demand to maintain leadership. Economic efficiency, modernization, and advancement of commercial industry determine the health of a nation, not Wall Street nor the bankers. Private, not public, demand is the instrument for enlargement within the United States. The speed of the private sector in responding to economic information and technological development mocks the lethargy of our decision-making practices within government.²²

The global marketplace pits commercial competitors against each other as they fight for a piece of the U.S. and world market. Competition for market share and the race to meet customers' demands have accelerated technological advancement in an intimidating race, with each lap faster than the last. This advancement sometimes defies comprehension; success or failure is often determined by a company's or a country's technological leadership. Estimates reveal 80 percent of the world's productivity growth is attributable to technological development and progress in knowledge.²³ Noting the power of global commercial companies, Alvin and Heidi Toffler in War & Anti-War declared, "The rise of knowledge-intensive, high-tech economies is also marked by the multiplication of movement of people, goods, services, and especially information across increasingly porous borders."²⁴

Large and small commercial companies are replicating each other's historic advantages through the advancement of technology. Large companies gain speed and agility to sustain a one-on-one customer relationship. Small companies gain high-quality and cost effective research, development, and production.²⁵ Such advancements in commercial business practice have allowed companies worldwide to form alliances to gain competitive advantage.

Probably the most important lesson learned by commercial business and enhanced by technology is the criticality of "speed". The greatest challenge with new technology is the integration of complex systems, rather than innovation so used on a stand-alone system. No single company or a couple of dominant countries have all the necessary skills to speedily meet customers' needs. Faced with complexities of integration, commercial companies have significantly reduced their product development times from years to months. Customers expecting immediate benefit from new products or service drive product life cycles downward.²⁶ We have truly become dependent on operating within a "system of systems" to generate instantaneous, precise answers to real-time problems.

Speed with quality and acceptable cost have become so important to a company's growth that commercial companies are trying to develop and produce products before the customer perceives a need for the product. Agility and productivity are today's commercial "golden rule". A basic rule: Do not store inventory or raw materiel in a rapidly changing global market environment. Addressing this rule, Roger Bahnsen and Woodrow Chamberlain in Manufacturing: The Quest for World-Class Performance observed that: "Products in motion are accruing in value, while assets and product at rest become cost centers."²⁷

To achieve cost competitiveness and customer loyalty in a global market, commercial companies are driving quality into every product and process they produce. Not only does quality attract customer preference, it also serves to establish long term supplier - manufacturer relationships. Robert Williams, Travelers Home Equity Service, told the American Banker Conference, "People are no longer buying just products or

services...they are buying relationships.”²⁸ Profits aside, the growth objective for commercial companies focuses on creating a mutually beneficial relationship between the customer, supplier of a service or manufacturer of a product, and their supply base.²⁹

Commercial manufacturers have undergone a radical change: previously every manufacturing operation involved humans. Now machines control and produce almost every item we use. This automation in product and process from drawing to tooling, linked with the agility to make short product runs with minimal downtime, are generating condensed product-to-shelf cycle times.³⁰ Stephen Cohen and John Zystman have labeled this manufacturing process as static flexibility, “the ability of a firm to adjust its operation at any moment to the shifting conditions of the market....Static flexibility decreases the risk that the firm won’t be able to adapt to changes in the number and types of goods demanded in the market; it increases the ability to adapt to changed conditions.”³¹

For speed and agility, this highly adaptive and changing process requires vast amounts of information. Computer-generated system development and associated computer drawings that control the production processes and computer-controlled machine instructions have become the norm for commercial companies. Thus, “Demassified production occurs--short runs of highly customized products.” According to Alvin and Heidi Toffler, “the very complexity of the new system requires more and more information exchange among its units: companies, government agencies, hospitals, associations, other institutions, and individual people.”³² Commercial companies are redefining or reengineering both the markets they can or will compete in and their

future directions for such short product cycles. Whereas they may be constantly "shifting directions" they none the less have a good notion of where they are going in the longer run.

In early 1991, a survey of high technology companies by Technologic Partners and Ernst & Young found that in, "more than half of the systems, companies saw product life spans of 36 months or longer five years ago, most now expect their products to survive for less than three years, and the overwhelming majority expect average life span five years from now to be less than 18 months."³³ As product life shortens, commercial companies are now re-engineering their supply chain for electronic integration of all customers and vendors. This will allow companies the agility to meet long-term and short term orders in near real-time. This logistics union of the supplier, manufacturer, and customer provides "the right things at the right time to the right place", while assuring a competitive price irrespective of the location of each.³⁴

The private sector has a long history of designing, developing, and marketing innovative, cost-effective technologies. The Army must now free itself from complete dependence on defense-unique contractors and increase its access to the defense-related products and processes that constantly emerge from the competitive commercial environment. According to Alvin and Heidi Toffler, "When we look beyond (commercial) products and technologies to their components and subtechnologies, the number of potential military permutations skyrockets."³⁵ However, the defense of the country requires defense-unique military systems (for example, missiles, projectiles, tanks). We must seek the best of both worlds: separate defense and commercial industrial sectors integrated into a "national industrial base."³⁶

COMMERCIAL-DEFENSE INDUSTRY

U.S. National Security relies on its industries, scientists, engineers, and entrepreneurs to capitalize on technology and control the birth-till-death process of the newly created technology. Following WWI, DoD laid the foundation for the computer industry. However, recently commercial industry has picked up the gauntlet and now leads the funding and capitalization of future computers and state-of-the-art semiconductors. Many of the information-based technologies critical to military superiority and our way of conducting war are already in use or are being pushed out of the development cycle in the world-wide commercial marketplace. Our children already play on more advanced computer war games and use superior computers to those accessed by our front line troops and commanders. The president of Fujitsu Systems Integration Laboratories recently pronounced that, "Commercial and military technologies are converging so rapidly that the day when there was such a thing as military technology is fast disappearing."³⁷

In Defense Conversion: Transforming the Arsenal of Democracy, Jacques Gansler offers this insight of integration of military and commercial technologies, "During the 1990s, four major technological changes took place that make civil and military integration far more attractive and greatly facilitate its implementation. They are: the growing commonality of critical military and civilian technologies; the availability of highly reliable, rugged, and high-performance commercial parts; the development and application of flexible ("agile") manufacturing; and the widespread industrial application of electronic data interchange."³⁸

An integrated commercial and defense industrial base invokes a central theme of the commercial marketplace providing the majority of defense needs or services. Integration would allow the military to reap the cost savings from leading-edge commercial technology while focusing scarce defense funds on military-unique technology. Military acquisition of these commercial products or sub-components, according to a recent Coopers and Lybrand study, would yield a savings of 20 to 40 percent.³⁹ DoD reliance on commercial facilities, rather than defense-unique industry, would facilitate a more rapid capability to rebuild or build systems in time of crisis.⁴⁰

The commercial sector's continuous stream of innovations dominates the design of weapon systems, sub-components, and parts in the future. Modern and state-of-the-art commercial facilities produce commercial and military systems on the same lines as commonly purchased commercial parts and subsystems. Under Secretary of Defense for Acquisition and Technology Dr. Kaminski, continuously preaches that "the military advantage will go to the nation with the best cycle time to capture commercial technologies, incorporate them in weapon systems and field new operational capabilities."⁴¹

Military and commercial products use many of the same current and developing technologies, such as polymer matrix composites for airframe structures and optoelectronics for advanced computers and flat-panel displays. Electronic systems and sub-systems consume about 45 percent of DoD's R&D and procurement budgets. However, DoD represents only a very small buyer on the world market for these technologies.⁴² To keep current with leading commercial technology, DoD's acquisition reform expanded the definition of "commercial" to include all commercial facilities and

commercial articles made in defense-unique companies. This allowed DoD to maximize its commercial purchases, thereby further integrating the national security and commercial industrial bases.

Even with our abundance of integrated commercial and military technology and manufacturers, only military-unique technologies and defense-unique manufacturers produce submarines, aircraft carriers, aircraft, munitions, and combat vehicles. "A nation can't buy off the shelf or out of the catalog and maintain technological superiority," according to Dr. Anita K. Jones, Director of Defense Research and Engineering. "Leadership in 'enough' of the defense-critical technologies is required to assure national security."⁴³

Driven by massive budget reductions, excess capacity and the introduction of commercial practices within DoD, defense companies have undergone major restructuring and mergers to become leaner and more commercially competitive. Since 1991, military industrial mergers worth \$39.4 billion have occurred. The Clinton administration, unlike previous administrations, have driven the companies to this decision, "making the economy more competitive globally."⁴⁴

We have thus not chosen to attempt to resuscitate a wounded defense-unique industrial base. This base lacked the capacity to quickly rebuild in time of crisis, returned little wealth to investors, and contributed little to commercial marketplace. Without defense dollars, defense companies were not investing in technology comparable to that being developed in the commercial world – a process that IBM's former chief scientist describes as the "ghettoization of defense technology."⁴⁵ The mergers have produced U.S. defense-unique companies that can focus on superior

systems design, integration of multiple components, and integration of various weapon systems so they work properly. Howard Rubel, an analyst at Goldman Sachs & Co., observed that, "This allows the Pentagon to do a lot less micromanaging. The companies can now do everything except fight the wars. That lets the Pentagon focus on what presumably it does best."⁴⁶

Key to integration of the commercial marketplace into DoD will be the ability of the military to gain timely access to the continually changing commercial technology while balancing defense-unique technologies and systems integration capabilities provided by defense contractors. Commercial manufacturing has created a global, virtual network of communications, infrastructure, and transportation systems; linking many suppliers and developers worldwide, irrespective of location. Commercial technologies are advancing so fast that a manufacturer must be the "best"; "just staying competitive" is not enough. The military must adapt to this environment if it is to incorporate the market-driven efficiencies of commercial industry.

Front-line advanced military systems rely on technology for military superiority and for cost-effectiveness through their entire life cycles. Technologically acquired military dominance saves lives; the commercial firm funded to develop that technology earns a profit and contributes to saving those lives. Commercially developed technology used to save, sustain, and better military lives furthers the civilian company's growth and profits. The economy then benefits that much more.⁴⁷

GOVERNMENT DEPOTS

The third component comprising the commercial-defense industrial base is the military depots. Depots are responsible for repair, rebuilding, and major overhaul of weapon systems, support systems, parts, assemblies, and subassemblies. They may also manufacture and reclaim parts, conduct testing, and maintain software. Depots serve as peacetime facilities and as a surge capability for the nation in time of crisis, giving commercial industry time to mobilize. Since 1988, depots have downsized and consolidated. However, the workload at many of the remaining depots utilizes less than 50 percent of assets or facilities.

The restructured commercial-defense industrial base keeps depot facilities only where no commercial counterpart is available. The plant equipment, manufacturing capability and technical knowledge at commercial and defense-unique companies far surpasses that of the depots. By performing depot maintenance or overhaul in the same facility as where the product was manufactured, DoD realizes equivalent economies of scale. The government benefits from having the latest commercial technology introduced concurrently in commercial and government systems or subsystems. With access to the latest technology, parts for future repairs are easier and cheaper to obtain. We have opportunities to save tax dollars and reduce government financing in the logistics infrastructure by increasing our use of these private sector capabilities.⁴⁸

The ideal scenario involves a shift to readily available and high-performing commercial enterprise under an outsourcing alternative. Outsourcing authorizes movement of a function previously performed in-house to an outside provider.

Outsourcing has become one of today's most powerful, organization-shaping management tools. Businesses, who outsource, grow not because they invest in everything, but because they focus on growing their advantages. Outsourcing to commercial maintenance or manufacturing firms provides a means for the government to benefit from technologies and systems that the government itself cannot acquire or operate economically.

The government also gains better quality from outsourcing. As Deputy Secretary of Defense John White states, "DoD's core competency is conducting military operations."⁴⁹ Commercial businesses as well as government agencies outsource logistics functions to:

- Redirect funds to core mission by avoiding capital investments in redundant facilities and processes that already exist in the commercial world.
- Focus on the core business while outsourcing other functions to commercial "masters". They can determine proper mix, cycle time, and size of resources required as the situation changes.
- Quickly establish best industry practices and technologies and implement system changes more efficiently.
- Focus on "core" functions, strategic planning, and direction.⁵⁰

The advantages of outsourcing and competition are apparent every day in our national economy; they are not conceptual or based on unreliable assumptions. A University of Tennessee study conducted for Federal Express in 1996 identified many of the same benefits cited by purchasers of third-party services as listed above.⁵¹ The Office of Management and Budget estimated that on average government "outsourcing" saves 20 to 30 percent per contract; it estimates that complete outsourcing could probably save billions of dollars every year.⁵² The 1996 Defense Science Board Task

Force on Privatization and Outsourcing found that 40 percent could be saved when the public sector (depots) outsourced to competitive commercial businesses.⁵³

Today almost any organization, business, or government can gain access to needed resources and most technologies. Outsourcing requires leaders and managers of companies and organizations to reengineer the traditional comfortable vertical stove-piped acquisition system into an agile system of core competencies and technology enhancing long-term alliances. What dictates success is the entity's growth in their intellectual capital, knowledge, and expertise, which then generates profit or military dominance.⁵⁴

LOGISTICS ENHancers

Strategic logistics must obtain materiel and services for the soldier from the commercial-defense sector. Logistics systems and processes then facilitate the continued integration of this materiel and services until it is in the hands of the soldier. Defense budgets will no longer support our investment in large infrastructures and inventory. The Army strategic logistics system must become leaner, more flexible, and more responsive. The logistics infrastructure must support a wide range of potential contingencies responding to an uncertain threat, at any time and place of conflict. Commercial industries and technologies, managed in accordance with commercial business practices and processes, can be integrated into the military logistics system.

Future conflicts will allow little lead time for mobilization of the industrial base and enlargement of the logistics system. Our logistics system requires rapid transportation, tailored and adaptable maintenance support, and greater reliance on

commercial sector services. In a world of rapidly progressing technology and processes, ownership of inventory for “just-in-case” situations runs wholly counter to current commercial practice. Commercial companies use fast, cheap transport to avoid costly inventory. A Rand study conducted as part of the Defense Science Board 1996 Summer Study found that the average for commercial industry materiel delivery was 1-3 days, but for DoD the average delivery required 26 days.⁵⁵

Joint Vision 2010 defines “Focused Logistics” as “the fusion of information, logistics, and transportation technologies to provide rapid crisis response, to track and shift assets even while enroute, and to deliver tailored logistics packages and sustainment directly at the strategic, operational and tactical level of operations.”⁵⁶ The Defense Total Asset Visibility (DTAV) system integrates all of DoD’s logistics computer systems and processes to provide near real-time access and accurate information on the location; movement; status; and identity of units, personnel, equipment, and supplies. It also includes the capability to act upon DTAV information. The system design maximizes proven commercial practices, capabilities and technologies that receive and ship materiel and services worldwide in a relatively short time. Under the DTAV system, logistics cultures in all services and DoD agencies are changed from “unit/agency ownership” to “unit/agency ownership with national visibility, access and control.”⁵⁷

Electronically linking developers, producers, tiers of vendors, and suppliers to the government agencies and units in a tight, seamless network of commercial activity is the goal of the Continuous Acquisition and Life-Cycle Support (CALS) system. CALS affords development, manufacturing, sustainment, and maintenance of systems,

subsystems, and parts to be accomplished in real time through a common digital data base shared by all. The CALS system offers substantial reductions in product-to-market time and costs, along with significant enhancements in quality and performance. Through a seamless integration of the government, manufacturers, and vendors, CALS supports innovative developments, improves the velocity and effectiveness of responding to requirements, improves management of materiels and maintenance, and allows the supply systems to react swiftly to changing demands.⁵⁸

ACQUISITION REFORM

Acquisition reform is designed to more effectively and efficiently obtain needed goods and services by applying commercial business practices to how we purchase and what we purchase. Using commercial cost-saving practices, DoD will reinvest savings into under-nourished modernization programs while accelerating the modernization of the nation's industrial base. The Federal Acquisition Streamlining Act (FASA) of 1994 passage improved various aspects of the acquisition process. Defense Secretary William Perry issued the key directive: "DoD must reduce the cost of the acquisition process by the elimination of activities that...are not necessary or cost effective in today's environment."⁵⁹

The acquisition process has undergone a complete change. We no longer tell the contractor how to build something according to military specifications and standards. The government prescribes the performance required of the system or item, then the contractor - using commercial business practices and technologies - builds the required item. Commercial practices and procedures eliminated the requirement for

hundreds of thousands of specifications, standards, practices, and continuous government oversight. One set of single commercial processes and practices in a plant containing multiple DoD customers became the rule for modifying ongoing contracts. This initiative triggered the integration of the commercial-defense industry. Now "Texas Instruments can use the same processes to make commercial and government products, and in turn, they have the flexibility to allow their suppliers to consolidate the number of their processes."⁶⁰

The Federal Acquisition Reform Act (FARA) of 1996 provides additional authority for simplifying the purchase of commercial items up to \$5 million and clarifying the rules on what constitutes a commercial item. We are beginning to achieve real success in a bold, new, reengineered oversight and review process that better serves our warfighters and conserves public funds. Industry consistently showed DoD that the way to lower costs, increased technology cycle-time, and quality was to get out of the business of telling industry how to build the item. By implementing commercial business practices, DoD is "experiencing cost avoidance's and savings in the \$100s of millions—a few (programs) in the billions of dollars."⁶¹

Unfortunately, DoD logistics operations and services currently face legal, financial, and mission obstacles that may make it difficult for them to match best commercial practices. No matter how many practices we change for the good of DoD, many current laws and regulations throw up barriers against DoD's fully integrating the commercial-defense industrial base and competitively outsourcing depots and related logistical functions to commercial industry. Laws that prescribe what percentage of work goes to depots and commercial companies inhibit the government from utilizing its

funds in the most efficient manner and from freely applying good commercial business practices. Only when Congress joins the team can we plan to fully integrate the commercial defense industrial base. Then, the U.S. Congress is finally accountable for sustaining the industrial base and the economy of the nation.

CONCLUSION

Introducing change in government...it ought to be remembered that there is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success, than to take the lead in the introduction of a new order of things. This coolness arises partly from fear of the opponents, who have the laws on their side, and partly from the incredulity of men, who do not readily believe in new things until they have a long experience of them.⁶²

Declining defense budgets and the rapid expansion in commercial technology require DoD to intensify their efforts to use civilian firms to supply state-of-the-art systems, subsystems, and services at competitive prices. Massive downsizing and mergers in the defense-unique industry have established their more restricted role in the future production of large weapon systems and unique defense requirements. An integrated commercial and defense industrial base advances defense technology and materiel, enhances U.S. economic competitiveness, and provides U.S. industry with the benefit of combined, larger markets.

By seizing on the commercial marketplace decision cycle, DoD gains access and the ability to apply arising new commercial technology. Then, DoD must leverage commercial skill and investments to reengineer the government's way of doing business. This strategy allows the armed forces to exploit the rapid innovation and market-driven efficiencies of commercial industry to meet defense needs. By drawing

on commercial technology and capabilities wherever possible, along with the superior systems design and integration skills of U.S. prime contractors, DoD can do its job more effectively and at a lower cost.

This new way of doing business requires U.S. commercial industries to remain at the cutting edge in those technologies that are critical to our military capabilities. While the commercial sector offers advanced technology on the open market, DoD directs its resources and defense-unique industries to fill the void. At the same time, DoD must maintain up-to-date knowledge on commercially available technologies. In today's environment, integrating defense and commercial technology can enable us to sustain our global military superiority.

In the commercial environment, complex systems, capability and efficiency, increases with each new generation; development cycles for new systems, subsystems, and processes shrink; and costs continue to decrease. Commercial industry spent over \$100 billion in 1996 in technological development. In recent years, commercial CEOs and managers spent more than half-trillion dollars annually on logistics.⁶³ Flexible manufacturing capability, now being widely introduced into commercial industries, permits the military to design and purchase commercial items directly from the manufacturing line. The power of the information age will transform this integration into a true partnership between military and industry. Increased commonality in design and materials between military and civilian use equipment will enhance surge and regeneration capabilities in time of crisis.

Acquisition reform began the process of creating revenue for modernization by taking advantage of commercial technology and processes. Government contracts now

use commercial standards instead of military specifications and standards. The purchase of commercial products removed barriers between the military and commercial marketplace. Further vital reform will provide for the complete integration of commercial technologies, industries and practices into DoD's peace and wartime operations. Competitive outsourcing will save much needed dollars while taking advantage of the latest commercial technology. No single business unit has all the necessary capabilities, neither does a single company nor country.

Logistics operations and support are growing more crucial as modern warfare increases in technological sophistication, complexity, speed and cost. The ability to adapt to change is the strength of the U.S. economy. U.S. economic soundness and its stamina continually triggers further change, ultimately enriching its technology - which leads to investments in productivity. Within the U.S., cooperation among the civilian and national security sectors is essential if we are to increase the technological capabilities and decrease costs of our military systems - while meeting the goals of fiscal restraint necessary for the economic health and security of the nation. More importantly, integration of the commercial and national security sectors serve to reduce the government infrastructure and capitalization needs, thereby binding the participants into a closer, more productive working relationship.

ENDNOTES

¹ Robert A. Novack, Lloyd M. Rinehart, and Michael V. Wells, "Rethinking Concept Foundations in Logistics Management," Journal of Business Logistics, Volume 13, Number 2, (1992): 233-267.

² Joseph M. Hieser, Jr., A Soldier Supporting Soldiers (Washington: Center of Military History, United States Army, 1991), 234.

³ "The Problem—Why Change Is Necessary" (DoD-TACNET, Test and Evaluation Community Network, 2 December 96); available from <http://140.229.1.16:9000/htdocs/teinfo/mand.html>; Internet; accessed 12 Jan 97.

⁴"The Problem, accessed 12 Jan 97.

⁵ Ibid.

⁶ C. John Langley, Jr. And Mary C. Holcomb, "Creating Logistics Customer Value" (Journal of Business Logistics Vol 13, no. 2); available from <http://www0.fedex.com/logistics/experts/create.html>; Internet; accessed 27 Oct 96.

⁷ Office of the Deputy Under Secretary of Defense (Logistics), Department of Defense Logistics Strategic Plan 1996/1997 (Washington: U.S. Department of Defense, 22 June 1996), 2-5.

⁸ Lieutenant General John J. Cusick and Lieutenant Colonel Carol D. King, "A Joint Logistics Vision for the Future," Logistics Spectrum (November/December 1996): 7.

⁹ Roger Bahnsen and Woodrow Chamberlain, "Manufacturing: The Quest for World-Class Performance" (Perspectives, November 1995); available from <http://www.csc.com/about/manufact.html>; Internet; accessed 13 January 1997.

¹⁰ John Phillips and Lou Chaker, "The Future of Defense Logistics: Making It Happen," Logistics Spectrum (November/December 1996): 12.

¹¹ Paul G. Kaminski, "Re-Engineering Defense Logistics" (DoD Logistics Offsite Conference, 24 Oct 96); available from <http://www.dtic.dla.mil/defenselink/pubs/di96/>; Internet; accessed 27 Oct 96.

¹² Gary Hamel and C.K. Prahalad, Competing for the Future (Boston: Harvard Business School Press, 1994), 19.

¹³ Richard C. Leone, "Defense Conversion" (Foreword on "Defense Conversion: Transforming the Arsenal of Democracy", 1995); available from <http://epn.org/tcf/xxgans02.html>; Internet; accessed 5 Jan 97.

¹⁴ Jacques S. Gansler, "Modernization Hinges on Acquisition Reform, Outsourcing, Industry Rehab," National DEFENSE (January 1997): 20-22.

¹⁵ Office of Science and Technology, "National Security Science and Technology Strategy 1996"; available from <http://www.whitehouse.gov/WH/EOP/OSTP/nssts/html/nssts.html>; Internet; accessed 27 Oct 96.

¹⁶ U.S. Department of Commerce, Office of Technology Policy, "Technology in the National Interest 1996"; available from <http://www.ta.doc.gov/techni/chp5a.htm>; Internet; accessed 27 Oct 96.

¹⁷ Ken Girardini et al., "Improving DoD Logistics: Perspectives from RAND Research" (Preface to CORM's final report "Directions for Defense", 1995); available from <http://www.rand.org/publications/DB/DB148.html>; Internet; accessed 8 September 1996.

¹⁸ Anita K. Jones, "Where Economic Security and National Security Intersect" (Director of Defense Research and Engineering Paper, Jan 97); available from <http://www.dtic.mil/ddre/articles.html>; Internet; accessed 11 Feb 97.

¹⁹ Office of Science and Technology Policy, "Integrating the Commercial and Defense Sectors, 1993" (None: America's Advantage Dual-Technology Policy, Feb 95); available from http://www.dtic.dla.mil/techtransit/nec/nec_integrate.html; Internet; accessed 3 Nov 96.

²⁰ Ibid.

²¹ President, "Economic Report of the President, 1997," U.S. Government Printing Office (Washington, D.C. 10 February 1997): 35.

²² Ibid, 23.

²³ U.S. Department of Commerce, Office of Technology Policy, "Technology in the National Interest 1996".

²⁴ Alvin and Heidi Toffler, War and Anti-War (Boston: Little, Brown and Company, 1993), 185.

²⁵ U.S. Department of Commerce, Office of Technology Policy, "Technology in the National Interest 1996".

²⁶ Gary Hamel and C.K. Prahalad, 36-37.

²⁷ Roger Bahnsen and Woodrow Chamberlain.

²⁸ William H. Davidow and Michael S. Malone, The Virtual Corporation (New York: HarperBusiness, 1992), 154.

²⁹ Patrick M. Byren and William J. Markham, Improving Quality and Productivity in the Logistics Process (Chicago: A.T. Kearney, Inc, 1991), 37 & 44.

³⁰ William H. Davidow and Michael S. Malone, 109-110.

³¹ Stephen S. Cohen and John Zysman, Manufacturing Matters (New York: Basic Books, 1987), 131.

³² Alvin and Heidi Toffler, 22-23.

³³ Technologic Partners Computer Letter, 8 July 1991, in William H. Davidow and Michael S. Malone, The Virtual Corporation (New York: HarperBusiness, 1992), 112.

³⁴ Jim Erickson and Chris Horrocks, "Vendor Partnerships in Manufacturing" (Perspectives, Nov 95); available from <http://www.csc.com/about/vendpart.html>; Internet; accessed 13 Jan 97.

³⁵ Alvin and Heidi Toffler, 22-23.

³⁶ Paul G. Kaminski, "Defense Industry Challenges and Opportunities" (Silicon Valley Defense/Space Consortium 2nd Annual Silicon Valley Defense Acquisition Conference Speech, 11 Jul 96); available from <http://www.dtic.dla.mil/defenselink/pubs/di96/di1185.html>; Internet; accessed 27 Oct 96.

³⁷ Jacques S. Gansler, Defense Conversion: Transforming the Arsenal of Democracy (Cambridge: The MIT Press, 1995), 101.

³⁸ Ibid., 91.

³⁹ Lieutenant General (R) Donald Pihl, "Commercial Specifications: An Industry View," Army RD&A, (January-February 1996): 13-14.

⁴⁰ "Integrating the Commercial and Defense Sectors", 28 July 1993.

⁴¹ Paul G. Kaminski, "U.S. Perspective on Defense Industrial Base Trends" (NATO Workshop on Political-Military Decision-making Speech, Warsaw, Poland, 21 June 1996); available from <http://www.dtic.mil/defenselink/pubs/di96/di1184.html>; Internet; accessed 5 Oct 96.

⁴² James Sterngold, "Analysis: U.S. Promotes Swift Change in Weapons Industry," The New York Times, 16 December 1996, iv.

⁴³ Anita K. Jones, 11 Feb 97.

⁴⁴ James Sterngold, iv.

⁴⁵ Jacques S. Gansler, 5 January 1997.

⁴⁶ James Sterngold, iv.

⁴⁷ Anita K. Jones, 11 February 1997.

⁴⁸ Paul G. Kaninski, "Re-Engineering Defense Logistics".

⁴⁹ John P. White, "Outsourcing Stretches DoD Dollars," Defense 96 (Issue 3): 20.

⁵⁰ Shirley A. Bergman, "Outsourcing Logistics Functions," Logistics Spectrum (November/December 1996): 19.

⁵¹ FedEx Learning Lab, "Top 10 FAQs"; available from <http://www0.fedex.com/logistics/faq/index.html>; Internet; accessed 27 Oct 96.

⁵² Cliff Sobel and Loren Thompson, "The Readiness Trap" (The Heritage Foundation, 95); available from http://www.conservative.org/heritage/p_review/spring95/thomph.html; Internet; accessed 11 Sept 96.

⁵³ U.S. Department of Defense. Achieving an Innovative Support Structure for 21st Century Military Superiority, (November 1996), Defense Science Board 1996 Summer Study Report. Washington, D.C. November 1996, Open Report. II-2.

⁵⁴ Frank Casale, "Outsourcing: How Industry Leaders are Reshaping the American Corporation" (The Outsourcing Institute, 1995); available from <http://www.outsourcing.com/getstart/95seintr.html>; Internet; accessed 11 Jan 97.

⁵⁵ DoD Achieving an Innovative Support Structure, I-17.

⁵⁶ Joint Chiefs of Staff, Joint Vision 2010, Joint Chiefs of Staff Vision (Washington: U.S. Joint Chiefs of Staff, July 1996) 15.

⁵⁷ Department of Defense, Defense Total Asset Visibility Implementation Plan, (Washington: Under Secretary of Defense for Acquisition and Technology), Department of Defense, 1996) 2-1 - 2-6.

⁵⁸ Stanley Dubowski, "CALS Strategic Overview" (OSD CALS Program, 2 Sep 96); available from http://www.acq.osd.mil/cals/temp/09_02_96/mp_vol_1.htm; Internet; accessed 5 Oct 96.

⁵⁹ William J. Perry, "Three Barriers to Major Defense Acquisition Reform," Defense Issues, (8, no. 65, 1993): 1-3.

⁶⁰ Paul G. Kaminski, "Institutionalizing Standards Reform" (1996 Joint Conference on Standards Reform Speech, 13 Nov 96); available from http://www.acq.osd.mil/ousda/speech/standards_reform.html; Internet; accessed 22 Feb 97.

⁶¹ Ibid.

⁶² Niccolo Machiavelli, "On Introducing Change in Government," in Defense Conversion: Transforming the Arsenal of Democracy, ed. Jacques S. Gansler (Cambridge: The MIT Press, 1995), 219.

⁶³ Lieutenant General (R) William G. Pagonis and Jeffery L. Cruikshank, Moving Mountains: Lessons in Leadership and Logistics from the Gulf War (Boston: Harvard Business School Press, 1992), 206.

BIBLIOGRAPHY

Bahnsen, Roger and Woodrow Chamberlain, "Manufacturing: The Quest for World-Class Performance." Perspectives, November 1995. Available from <http://www.csc.com/about/manufact.html>; Internet; accessed 13 January 1997.

Bergman, Shirley A., "Outsourcing Logistics Functions." Logistics Spectrum (November/December 1996): 19.

Byren, Patrick M. and William J. Markham, Improving Quality and Productivity in the Logistics Process. Chicago: A.T. Kearney, Inc, 1991.

Casale, Frank, "Outsourcing: How Industry Leaders are Reshaping the American Corporation." The Outsourcing Institute, 1995. Available from <http://www.outsourcing.com/getstart/95seintr.html>; Internet; accessed 11 January 1997.

Cohen, Stephen S. and John Zysman, Manufacturing Matters. New York: Basic Books, 1987.

Cusick, John J Lieutenant General and Lieutenant Colonel Carol D. King, "A Joint Logistics Vision for the Future." Logistics Spectrum (November/December 1996): 7.

Davidow, William H. and Michael S. Malone, The Virtual Corporation. New York: Harper Business, 1992.

Dubowski, Stanley, "CALS Strategic Overview." OSD CALS Program, 2 Sep 96. Available from http://www.acq.osd.mil/cals/temp/09_02_96/mp_vol_1.htm; Internet; accessed 5 Oct 96.

Erickson, Jim and Chris Horrocks, "Vendor Partnerships in Manufacturing." Perspectives, Nov 95. Available from <http://www.csc.com/about/vendpart.html>; Internet; accessed 13 Jan 97.

FedEx Learning Lab, "Top 10 FAQs." Available from <http://www0.fedex.com/logistics/faq/index.html>; Internet; accessed 27 Oct 96.

Gansler, Jacques S., Defense Conversion: Transforming the Arsenal of Democracy. Cambridge: The MIT Press, 1995.

Gansler, Jacques S., "Modernization Hinges on Acquisition Reform, Outsourcing, Industry Rehab." National DEFENSE (January 1997): 20-22.

Girardini, Ken et al., "Improving DoD Logistics: Perspectives from RAND Research." Preface to CORM's final report "Directions for Defense", 1995. Available from <http://www.rand.org/publications/DB/DB148.html>; Internet; accessed 8 September 1996.

Hamel, Gary and C.K. Prahalad, Competing for the Future. Boston: Harvard Business School Press, 1994.

Hieser, Joseph M., Jr., A Soldier Supporting Soldiers. Washington: Center of Military History, United States Army, 1991.

Joint Chiefs of Staff, Joint Vision 2010. Joint Chiefs of Staff Vision. Washington: U.S. Joint Chiefs of Staff, July 1996.

Jones, Anita K., "Where Economic Security and National Security Intersect." Director of Defense Research and Engineering Paper, January 1997. Available from <http://www.dtic.mil/ddre/articles.html>; Internet; accessed 11 February 1997.

Kaminski, Paul G., "Defense Industry Challenges and Opportunities." Silicon Valley Defense/Space Consortium 2nd Annual Silicon Valley Defense Acquisition Conference Speech, 11 Jul 96. Available from <http://www.dtic.dla.mil/defenselink/pubs/di96/di1185.html>; Internet; accessed 27 Oct 96.

Kaminski, Paul G., "Institutionalizing Standards Reform." 1996 Joint Conference on Standards Reform Speech, 13 Nov 96. Available from http://www.acq.osd.mil/ousda/speech/standards_reform.html; Internet; accessed 22 Feb 1997.

Kaminski, Paul G., "Re-Engineering Defense Logistics." DoD Logistics Offsite Conference, 24 October 96. Available from <http://www.dtic.dla.mil/defenselink/pubs/di96/>; Internet; accessed 27 October 1996.

Kaminski, Paul G., "U.S. Perspective on Defense Industrial Base Trends." NATO Workshop on Political-Military Decision-making Speech, Warsaw, Poland, 21 June 1996. Available from <http://www.dtic.mil/defenselink/pubs/di96/di1184.html>; Internet; accessed 5 Oct 96.

Langley, C. John Jr. And Mary C. Holcomb, "Creating Logistics Customer Value." Journal of Business Logistics Vol 13, no. 2. Available from <http://www0.fedex.com/logistics/experts/create.html>; Internet; accessed 27 October 1996.

Leone, Richard C., "Defense Conversion." Foreword on "Defense Conversion: Transforming the Arsenal of Democracy", 1995. Available from <http://epn.org/tcf/xxgans02.html>; Internet; accessed 5 January 1997.

Machiavelli, Niccolo, "On Introducing Change in Government." in Defense Conversion: Transforming the Arsenal of Democracy, ed. Jacques S. Gansler, 219. Cambridge: The MIT Press, 1995.

Novack, Robert A., Lloyd M. Rinehart, and Michael V. Wells, "Rethinking Concept Foundations in Logistics Management." Journal of Business Logistics, Volume 13, Number 2, (1992): 233-267.

Office of the Deputy Under Secretary of Defense (Logistics), Department of Defense Logistics Strategic Plan 1996/1997. Washington: U.S. Department of Defense, 22 June 1996.

Office of Science and Technology Policy, "Integrating the Commercial and Defense Sectors, 1993." None: America's Advantage Dual-Technology Policy, February 1995. Available from http://www.dtic.dla.mil/techtransit/nec/nec_integrate.html; Internet; accessed 3 November 1996.

Office of Science and Technology, "National Security Science and Technology Strategy 1996." Available from <http://www.whitehouse.gov/WH/EOP/OSTP/nssts/html/nssts.html>; Internet; accessed 27 October 1996.

Pagonis, William G., Lieutenant General (R) and Jeffrey L. Cruikshank, Moving Mountains: Lessons in Leadership and Logistics from the Gulf War. Boston: Harvard Business School Press, 1992.

Perry, William J., "Three Barriers to Major Defense Acquisition Reform." Defense Issues. (8, no. 65, 1993): 1-3.

Phillips, John and Lou Chaker, "The Future of Defense Logistics: Making It Happen." Logistics Spectrum (November/December 1996): 12.

Pihl, Donald, Lieutenant General (R), "Commercial Specifications: An Industry View." Army RD&A, (January-February 1996): 13-14.

President, "Economic Report of the President, 1997." U.S. Government Printing Office, Washington, D.C. 10 February 1997.

Sobel, Cliff and Loren Thompson, "The Readiness Trap." The Heritage Foundation, 95. Available from

http://www.conservative.org/heritage/p_review/spring95/thompth.html; Internet; accessed 11 Sept 96.

Sterngold, James , "Analysis: U.S. Promotes Swift Change in Weapons Industry," The New York Times. 16 December 1996, iv.

"The Problem—Why Change Is Necessary." DoD-TACNET, Test and Evaluation Community Network, 2 December 1996. Available from <http://140.229.1.16:9000/htdocs/teinfo/mand.html>; Internet; accessed 12 January 1997.

Toffler, Alvin and Heidi, War and Anti-War. Boston: Little, Brown and Company, 1993.

U.S. Department of Commerce, Office of Technology Policy, "Technology in the National Interest 1996." Available from <http://www.ta.doc.gov/techni/chp5a.htm>; Internet; accessed 27 October 1996.

U.S. Department of Defense. Achieving an Innovative Support Structure for 21st Century Military Superiority (November 1996). Defense Science Board 1996 Summer Study Report. Washington, D.C. November 1996, Open Report.

U.S. Department of Defense, Defense Total Asset Visibility Implementation Plan. Washington: Under Secretary of Defense for Acquisition and Technology, Department of Defense, 1996.

White, John P., "Outsourcing Stretches DoD Dollars." Defense 96 (Issue 3): 20.